

The month closed with a deep depression over the interior of the United States that was attended by an extensive rain area over the eastern portion of the country, and followed by an area of high barometer and a cold wave over Manitoba and the north-central States. Over the Atlantic area the barometer was very low over Iceland and high over the Azores and southwestern Europe. Over the great Asiatic area after four days' depression the barometer had begun to rise. Over southern latitudes of the north Pacific Ocean pressure was above normal. The Pacific coast States were covered by an area of high barometer. This distribution of pressure indicated for the United States east of the Rocky Mountains several days of comparatively cool weather followed by a week or more of rather rapidly alternating periods of fair and showery weather and mild temperature.

**BOSTON FORECAST DISTRICT.\***  
[New England.]

The month as a whole was mild for the season, with less than the usual amount of precipitation. Storms were fewer and less severe than usual for March, and as a result there was little damage and no great delays to shipping. Storm warnings were displayed in connection with all storms.—*J. W. Smith, District Forecaster.*

**NEW ORLEANS FORECAST DISTRICT.\***  
[Louisiana, Texas, Oklahoma, and Arkansas.]

The month was mild and no general cold wave passed over the district. No storm warnings were issued and no general storm visited the west Gulf coast. Frost or freezing temperature warnings were issued on two dates and were partially verified.—*I. M. Oline, District Forecaster.*

**LOUISVILLE FORECAST DISTRICT.\***  
[Kentucky and Tennessee.]

The month was milder than usual, with deficient precipitation, except in the north-central portion of Kentucky. Heavy rains the first and latter portions of the month caused floods in the Ohio River and tributaries. No special forecasts were issued.—*F. J. Walz, District Forecaster.*

**CHICAGO FORECAST DISTRICT.\***  
[Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas, and Montana.]

Temperature was considerably above normal and no general cold wave occurred. Warnings for limited areas were, however, issued on five dates, which were followed by decided falls in temperature. Advisory messages were sent on several dates to open ports on Lake Michigan, and no casualties have been reported.—*H. J. Cox, Professor and District Forecaster.*

**DENVER FORECAST DISTRICT.\***

[Wyoming, Colorado, Utah, New Mexico, and Arizona.]

The month was quiet, with light precipitation and an excess of temperature, except in Utah and southwestern Wyoming. Cold-wave warnings were issued on the morning of the 25th for a cold wave that overspread Wyoming and north-eastern Colorado, and on the 31st for southern Wyoming and extreme northeastern Colorado.—*F. H. Brandenburg, District Forecaster.*

**SAN FRANCISCO FORECAST DISTRICT.†**  
[California and Nevada.]

The month was unusually dry, rain during the first five days being followed by a long rainless period. Frosts, for which ample warnings were issued, were frequent, but did no great injury. Snowfall in the mountains was very light as compared with last year.—*A. G. McAdie, Professor and District Forecaster.*

**RIVERS AND FLOODS.**

The only really disastrous floods of the month occurred in

\* Morning forecasts made at district center; night forecasts made at Washington, D. C.

† Morning and night forecasts made at district center.

Washington, Oregon, and northwestern Idaho, where the general heavy rains that fell from the 13th to the 15th, inclusive, were quickly followed by floods, particularly in the smaller streams, resulting in great damage, much inconvenience, interruption to business, and considerable suffering. Railroads were washed out, bridges were torn from their foundations and carried down stream, and outbuildings and loose effects carried away. Many millions of feet of lumber were carried down stream, but this was not entirely an unmixed evil, as it solved the problem of transportation of the lumber to the mills or market with little or no expense. No detailed reports of this flood have been received, and it is impossible to express in figures the extent of losses and damage.

The Columbia River rose but little.

The rainfall of the month over the Ohio watershed was quite abundant, and two floods of fair magnitude were the result. Both were well forecast, and neither did any damage of consequence, altho at Pittsburg, Pa., where the second flood reached a crest stage of 27.3 feet at 1 a. m. of the 20th, about five hundred cellars and basements were flooded, their contents having been previously removed. The first flood began on the 2d, at Pittsburg, and the crest past into the Mississippi on the afternoon of the 18th, the stage of water at Cairo, Ill., being 45.55 feet, 0.55 foot above flood stage. The second flood began on the 19th, at Pittsburg, and at the end of the month the advance waters had just about reached Cairo.

Generally speaking, the Ohio River was high thruout the month, with mean stages of 41.9 and 42.7 feet, respectively, at Cincinnati, Ohio, and Cairo, Ill.

The lower Mississippi River also remained high, its normal condition during this season of the year, and at the end of February the flood crest of that month had just past New Madrid, Mo. The rise continued below, and at Greenville, Miss., the river was still rising slowly when the advance waters of the first Ohio River flood reached that place. The flood stage of 16 feet at New Orleans, La., was first reached on the 9th, and since that date the river has not been below the flood stage.

Warnings of all the high waters were issued whenever necessary, and they were very precise both as to stage and time.

Disastrous floods were also experienced along the interior rivers of Ohio, Indiana, and Illinois. The Wabash and White rivers rose from 7 to 9 feet above the flood stage and thousands of acres of land were under water, bridges were carried away, and several railroads were seriously handicapped by washouts. The Illinois River also rose from 8 to 11 feet above flood stage and caused considerable damage of the usual kind, tho perhaps not so much as in Indiana. In Ohio much less damage was done. These floods were well covered by warnings, except in northern Indiana, where no service is maintained, and thru the advices given much property was saved that otherwise would have been lost or greatly damaged.

The floods in the Grand River of Michigan were the product of a fair rainfall on the 5th and 6th, combined with the run-off from a snowfall that averaged more than twice the normal amount for the month of February. The situation was also complicated by ice gorges between Grand Ledge and Ionia, Mich. Previous to the beginning of the rain nearly the entire length of the river was covered by a solid sheet of ice, averaging more than 1 foot in thickness, but the rain of the 5th and 6th and the warm sunshine from the 9th to the 13th, inclusive, rotted it so that it soon broke up and past down with but little damage. The first warnings were issued on the 7th, and supplementary ones frequently thereafter. The warnings were of great benefit, especially at Grand Rapids, where large quantities of merchandise, etc., were removed to places of safety. The city officials were also enabled, thru a warning given four days in advance, to prevent the flood from reaching the west side of the city.

The following remarks by Mr. C. F. Schneider, official in charge of the local office of the Weather Bureau at Grand Rapids, relative to the causes of floods in the Grand River are of interest in this connection. Besides explaining the causes of the floods of the day they are indirectly suggestive of grave future possibilities both on account of deforestation, and of increased rapidity of run-off and constricted channels.

It may be proper at this time for the writer to state what, in his opinion, are the principal causes of these disastrous floods. Many people attribute them almost entirely to the deforestation of the watersheds, and this undoubtedly is a great factor; but still greater factors, I believe, are the extensive system of farm, township, and county drains which cover the watershed, and the encroachment of the people on the lowlands of the river. In Grand Rapids, at the foot of Pearl street, there are two solid blocks of business houses where fifty or sixty years ago the river flowed, and so it is to a greater or less degree at Lowell and Ionia. The lowlands adjacent to the river are dotted with factories and houses. Baxter's History of Grand Rapids tells of numerous floods many years ago, when the water reached stages fully as high, and probably somewhat higher, than those experienced in recent years. Fifty or sixty years ago southern Michigan was one vast wooded expanse interspersed with large swamps that were natural reservoirs. To-day these swamps have nearly all been drained, and every township has its large ditch leading to the nearest creek or river, and the creeks and smaller rivers have themselves been drained to promote the flow of water. All this produces a very rapid congestion of the water, and as an auxiliary of no small proportion must be reckoned the extensive system of tile drainage instituted by the progressive farmers of southern Michigan. For these reasons I would say that altho deforestation is certainly a factor in promoting floods in southern Michigan, it is not so much so as in other parts of the United States, where the land is more hilly and some times much more rocky. The general drainage system of man and his encroachments on the lowlands are the principal causes of flood damage in southern Michigan.

There were moderate floods in the Hudson River from the 14th to the 16th, inclusive, due to ice gorges, and in the Connecticut River from the 29th to April 1st, inclusive. The timely warnings for these floods were much appreciated.

The small floods in the North Branch of the Susquehanna River from the 14th to the 16th, inclusive, past out without attention.

### SPECIAL ARTICLES, NOTES, AND EXTRACTS.

#### ACCIDENTAL VARIATIONS IN ATMOSPHERIC PRESSURE IN THE UNITED STATES.

By ALFRED J. HENRY, Professor of Meteorology. Dated February 19, 1908.

The auxiliary charts of the Forecast Division of the Weather Bureau contain a record of the 12 and 24-hour pressure changes for the last twenty years. The 12-hour periods extend from 8 a. m. to 8 p. m. and from 8 p. m. to 8 a. m., seventy-fifth meridian time; the first of these represents substantially the day hours, the second the night hours. The 24-hour pressure changes are made directly from the sea-level readings of one day as compared with those of the next. In obtaining the 12-hour changes a correction is applied to the actual difference between the successive, twice daily, readings in order to eliminate the effect of diurnal variation.

Inasmuch as the reduction to sea level on the western plateau and in the western mountain regions is somewhat uncertain, at times, on account of the temperature argument, the changes made from sea-level pressures for those regions may not represent true pressure changes at all times and in all seasons.

Areas of pressure fall or rise move across the United States generally from the west toward the east. Ordinarily each region of falling pressure is followed by a region of rising pressure. Sometimes, however, a second area of falling pressure moves in from the Pacific and gradually overtakes and merges with the preceding area of falling pressure.

In addition to moving areas of pressure change which attend cyclones and anticyclones, pressure is occasionally observed to rise or fall, spontaneously, so far as can be determined, over large areas. In this phenomenon the definite eastward movement, which is a characteristic of the ordinary areas of rise and fall, is absent. Such stationary areas of rise or fall occur

The approach of the floods that began early on the 24th in the Southern rivers had been heralded by the Weather Bureau on the day previous, and farmers and lumbermen spent a very busy day, the former in removing stock, etc., to places of safety, and the latter in preparing to remove lumber that had been waiting for such an opportunity.

No unusually high stages were reached and losses and damage were small, as the warnings enabled all to take necessary precautions.

The ice in the Mississippi River between Le Claire and Dubuque, Iowa, went out during the night of the 5th; at Prairie du Chien, Wis., on the 16th; at La Crosse, Wis., on the 11th; at St. Paul, Minn., on the 15th, and at Fort Ripley, Minn., on the 29th.

Navigation at Keokuk, Iowa, opened on the 10th.

The Missouri River remained frozen thruout the month in the vicinity of Wolf Point, Mont., but was practically open elsewhere after the 15th. At Sioux City, Iowa, the break-up occurred on the 3d, and the last ice of the season past Omaha, Nebr., on the 10th.

The upper Connecticut River opened on the 13th at White-river Junction, Vt., and on the 15th at Wells River, Vt. The lower Penobscot River opened on the 27th. The ice gorge in the Hudson River near New Baltimore, N. Y., the last one of the season, disappeared on the 22d, and navigation opened on that date.

The highest and lowest water, mean stage, and monthly range at 210 river stations are given in Table IV. Hydrographs for typical points on seven principal rivers are shown on Chart I. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—H. C. Frankenfield, Professor of Meteorology.

mostly in the warm season and in the daytime. Nothing is known as to their cause.

The amplitude of the fall in any region of diminishing pressure bears no relation to the amplitude of the rise in the succeeding area of rising pressure; thus the fall of the barometer in a series of cyclones may be uniformly greater than the rise in the succeeding anticyclones, and vice versa. As a result of these inequalities, the pressure over the continent is in continual fluctuation above and below the general mean. These general up and down pressure oscillations are separate and distinct from the local and moving areas of pressure fall and rise that usually attend the formation of cyclones and anticyclones.

Areas of falling pressure do not necessarily result in the formation of cyclones. In December, 1907, 12 well-marked cyclonic areas moved across the United States, while 19 separate and distinct areas of falling pressure were observed.

In order to determine the ratio of the pressure changes in the day hours to those of the night hours the most important cases of rising and falling pressure over the interior of the continent for December, 1907, were examined. No comparisons of the rate of change during day and night hours were made until after the areas of rising or falling pressure, as the case might be, had passed wholly within and over the interior of the continent.

The average 12-hour rise in pressure in 40 cases during the night hours was 0.32 inch; during the day hours, 0.35 inch. The average 12-hour fall in pressure during the night hours in 45 cases was 0.31 inch; during the day hours, in 41 cases, 0.32 inch. While these results show a slightly greater fluctuation of pressure over the continent during the day hours than during the night hours the differences are small. It is probable